Solving Archaeological Inverse Problems – A Reverse Engineering Approach

Juan A. Barceló

Quantitative Archaeology, Dept. of Prehistory, Faculty of Letters, Univ. Autònoma de Barcelona, Campus UAB (B9-119), 08193 Bellaterra, Spain

Watch the Video

Keywords: archaeology, inverse problems, reverse engineering, shape analysis, finite element method, 3D modeling

Reverse engineering has been defined as the study of a sample of a product, device or machine, to discover how it functions or was made. The goal is to find the functional principles that make it work. It may be simply measuring all the parts and analyzing the materials, to be able to reproduce it. The underlying idea seems to be if you learn how to make it, you know how it works. That means that if you can reconstruct the process by which the object was created, you will understand why it has that specific shape, and size, why it is made of this material, why its surface has those visual or tactile properties, etc.

Archaeology is a form of reverse engineering for the social sciences. It seems the best way to approach the classical archaeological problem, formally: reconstructing the cause – social action – based on an observation of the effects – the archaeological record.

In most current applications of the reverse engineering approach in archaeology, it seems reduced to digitalization: how to reconstruct the original surface based on a sample of 3D points acquired through photogrammetry or laser scans. However, as the very idea of reverse bioengineering brings about, reverse engineering is not restricted to digital imaging or shape analysis. In biological systems, reverse engineering has been invoked to understand how living beings have evolved, that is, the task of inferring adaptive function from structure. In this paper I consider this approach in functional analysis of different kinds of archaeological items, from buildings to bones, from pottery and instruments to territories. It presents different ways to express mathematically human behavior, making emphasis on inverse kinematics methods and different variations of the finite analysis method.

ORCID®

Juan A. Barceló https://orcid.org/0000-0002-1580-471X

Barceló, J. A. (2022). Solving Archaeological Inverse Problems – A Reverse Engineering Approach. In A. W. Kandel, M. N. Haidle, & C. Sommer (Eds.), *Human Origins – Digital Future: An International Conference about the Future of Archaeological and Paleoanthropological Databases* (p. 29). Propylaeum, Heidelberg.
DOI: https://doi.org/10.11588/propylaeum.882.c13436